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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/529,535	03/29/2005	Pyung-Yong Um	JO 01915	4563

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EXAMINER

ABRAMOWITZ, HOWARD E

ART UNIT PAPER NUMBER

1762

DATE MAILED: 10/11/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/529,535

Applicant(s)

UM, PYUNG-YONG

Examiner

Howard E. Abramowitz

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 March 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 March 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 7/11/05.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Drawings

Figures 1-2b should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 1 and 5, the applicant claims "the nitride film has a larger thickness at the upper region of the nitride film compared to those of the side regions and the lower regions thereof". This is indefinite because nowhere is it claimed that the film has a

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lower region or side regions. In order to have the claimed features, the substrate would have to have trenches otherwise the claim is nonsensical. However, there is no limitation of the substrate shape in the claims. For the purpose of this office action the the upper region will be considered the top of a trench the side regions will be considered the sides of a trench and the lower region will be considered the bottom of a trench.

Claims 2-4 are rejected for being dependent on a rejected claim.

Claim Rejections - 35 USC § 102

Claims 1-5 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sato et al. (US Patent No. 2002/0048971).

Referring to claim 1, Sato et al. discloses a method for depositing a nitride film using a chemical vapor deposition apparatus of a single chamber type comprising a process chamber comprising an inlet gas line through which process gases are introduced; a showerhead for spraying the introduced process gases; a heater on which the wafer is placed and a vacuum port for discharging the process gases (paragraphs 74 and 75, figure 5) the method including;

Depositing a first nitride film by performing a first nitride film deposition process while a mixture ratio of ammonia gas and silane gas, which are the process gases, injected in order to first deposit the nitride film is maintained at 100:1 (paragraphs 93 and 94). Since the first and second deposition steps can both be performed at a ratio 100:1 performing a single deposition at that condition meets the requirement of the claim.

The thickness at the upper region will inherently be larger than that of the side regions and lower region because as the trench fills with the nitride film it becomes narrower and will become more difficult for the nitride to diffuse into the trench and deposit on the sides and lower region than it will be to deposit on the upper region. As well, the side and lower regions are limited by the size of the trench and therefore can only grow to a limited thickness while the upper region has no bounds on the thickness of the layer therefore for long enough deposition times the upper surface will always be thicker than the sides and lower regions.

Alternatively Sato et al. teaches, depositing a first nitride film by performing a first nitride film deposition process while a mixture ratio of ammonia gas and silane gas, which are the process gases, injected in order to first deposit the nitride film is maintained in 100:1 or more (paragraphs 93 and 94) and; Depositing a second nitride film in situ at a different flow rate ratio of ammonia to silane (paragraph 26). It does not teach specifically to use a ratio of 100:1 or less in the second deposition process. However, Sato et al. teaches that the ratio of ammonia to silane adjusts the ratio of the thickness of the silicon nitride film deposited in a high

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gate-electrode-pattern density region to the thickness of the silicon nitride film deposited in a low density region (paragraph 93) and is open to the possibility that the ratio is less than 100:1. Therefore the ammonia to silane ratio is a result effective parameter in that it effects the thickness ratio of the silicon nitride film deposited in different regions. It would have been obvious to have adjusted the ratio of the ammonia to silane gas to values in the claimed ranges through routine experimentation so as to optimize the ratio of the film thickness in a high gate-electrode-pattern density region to the thickness of the silicon nitride film deposited in a low density region, especially in the absence of a showing of a criticality for using values in the claimed ranges.

Referring to claims 2-4 Sato et al. discloses an example where the silicon nitride layer is deposited with the process conditions: silane flow 20 sccm, ammonia flow 1400 sccm, nitrogen flow 3600 sccm, a pressure of 275 torr, and a temperature of 750 °C (paragraph 78).

Referring to claim 5, Sato et al. discloses a method for depositing a nitride film using a chemical vapor deposition apparatus of a single chamber type comprising a process chamber comprising an inlet gas line through which process gases are introduced; a showerhead for spraying the introduced process gases; a heater on which the wafer is placed and a vacuum port for discharging the process gases (paragraphs 74 and 75) the method including:


Maintaining the ratio of the ammonia and the silane gas, which are the process gases injected in order to first deposit the nitride film, in 5:1 or more to 50:1 or less (paragraph 93).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Howard E. Abramowitz whose telephone number is 571-272-8557. The examiner can normally be reached on monday-friday 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy H. Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER